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**RESEARCH
NOTES:**

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LIGHT USE STUDY FOR VERTICAL CHANNEL DEVICES

This report documents the findings of a research study for the Arizona Department of Transportation (ADOT) on the use of steady-burn warning lights on vertical panels in roadway construction zones.

While the Manual on Uniform Traffic Control Devices (MUTCD) does not require the use of warning lights on channelization devices for night-time roadway construction, ADOT has historically made this a requirement. The ADOT Traffic Control Supplement (TCS) to the MUTCD required the use of warning lights on all traffic control devices used for night-time construction work.

In June 2002, ADOT adopted a revision to this supplement that dropped the requirement for the use of warning lights on roadways that are continuously lighted.

Specific task efforts for this project included a search for relevant research reports and documentation on this topic, and a review of other state department of transportation requirements and policies regarding the use of steady-burn warning lights on traffic control devices.

The workscope also required a review of ADOT's construction zone requirements, a review of construction zone accident reports and incident logs on three recent projects that used Ultra Panels (Type III sheeting) without warning lights, and interviews with key ADOT field construction staff

regarding the past performance of vertical panels with and without steady-burn warning lights. The findings of each key research task are shown in the following sections.

LITERATURE SEARCH

The State of Arizona requires the use of warning lights on all traffic control channelization devices for night-time construction work. The literature search found some research that supported the use of traffic control devices without steady-burn warning lights, which is similar to the reported practices of most of the states that were surveyed. In contrast, other literature sources were found that strongly encouraged the use of steady-burn warning lights.

It is important to note that all of the literature found suggests that there are instances when using warning lights with traffic channelization devices is warranted and prudent.

NCHRP Report 236 was finalized in 1981 and concluded that steady-burn warning lights provided more guidance to motorists at night than reflectorized devices without lights. This report recommended the use of warning lights and Type III reflective sheeting on traffic control channelization devices.

Other reports were found which support the use of steady-burn warning lights on traffic

channelizing devices. These reports include *Warning Devices Type C Steady-Burn Lights*, prepared by the Institute of Vehicular Safety in 1992, *Steady-Burn Warning Lights*, prepared by KLD Associates in 1992, and a Michigan Department of Transportation internal memo written in 1989.

Two other reports, TRB 01-2293 and NCHRP 476, present a different viewpoint, concluding that steady-burn warning lights used at night did not enhance driver performance when attached to channelizing devices equipped with high intensity sheeting. Advances in vision enhancement systems and headlights can enhance driver's ability to see and locate hazards, but research was not found to clarify how these affect traffic sign retroreflectivity.

The Ultra Panel, a new type of vertical panel, has effected discussions in the traffic control industry of whether or not warning lights should be required. This device has a handle which makes it easy to maneuver. It is hollow, which makes it stackable, and it is made of plastic, which makes it relatively lightweight. It has a recessed area for reflective sheeting that is larger than areas on standard vertical panels. It has a wider base for greater stability and greater resistance to wind forces. ADOT construction forces that have used the Ultra Panel have been highly impressed by its performance.

The 3M Company, one of the largest manufacturers of reflective sheeting, was contacted to obtain information regarding the retroreflectivity of their sheeting products and the use of steady-burn warning lights.

The 3M Company's official position is to support the use of steady-burn warning lights on traffic channelizing devices. The 3M Company has written letters to several state transportation departments, including the states of Arizona, Florida, and Michigan encouraging these agencies to use or continue the use of warning lights on traffic control devices. The literature search found a review of the negative effect of dew on retroreflective sheeting, as reported by the 3M Corporation.

SURVEY OF STATE DEPARTMENTS OF TRANSPORTATION

A survey of other state transportation departments was conducted to determine these agencies' requirements for temporary barricading and the use of warning lights on temporary barricades. Thirty-three states and one Canadian province responded to the survey.

Twenty-three of the thirty-four responding agencies reported that they use vertical panels, with nineteen of these agencies using the vertical panels at night. The Alberta Transportation Department was the only agency that reported requiring steady-burn warning lights on channelization devices. The Illinois Department of Transportation requires warning lights on any roadway with an average daily traffic level over 2,500 vehicles per day.

The presence or amount of ambient lighting does not appear to be a factor in determining whether steady-burn warning lights on channelizing devices are required. Most of the agencies that responded to the survey indicated a minimum requirement of Type III (high intensity) reflective sheeting, with Type I and Type IV as other choices for minimum requirements. The minimum required retro-reflective sheeting does not appear to be influenced by the presence or lack of ambient lighting.

Only three of the responding agencies stated that they had conducted any research regarding the requirements for steady-burn warning lights.

Only the Wisconsin Department of Transportation has documented their study, which resulted in upgrading channelizing device retroreflective sheeting to high intensity (Type III) and omitting the requirement for steady-burn warning lights except in tapers. The significant results of this survey are presented in Table 1, at the end of this document.

USE OF ULTRA PANEL

Vertical panels without warning lights have been used on three highway construction projects

in Arizona. These three projects were design-build projects, namely I-17 from Thomas Road to Peoria Avenue in the Phoenix, US 60 from I-10 to Val Vista Drive in the east valley portion of the Phoenix metropolitan area, and SR 68 from Bullhead City to Golden Valley in rural Mohave County.

The Ultra Panel, a type of vertical panel, was first used by ADOT on the I-17 project, and was subsequently the predominant traffic channelization device used on the US 60 and SR 68 projects. ADOT field construction staff associated with these projects were in strong support of the use of the Ultra Panels (Type III sheeting) without warning lights and would recommend their use on future projects.

PROJECT REVIEWS

A review of accident records, traffic control logs, and interviews with ADOT staff for the three identified construction projects did not reveal any significant deficiencies associated with the use of the Ultra Panels without steady-burn warning lights.

In contrast to ADOT staff with experience using the Ultra Panels without warning lights, ADOT construction staff with experience only in using channelizing devices with warning lights were not as supportive as their counterparts. These individuals felt that traffic channelizing devices, and specifically vertical panels, benefit from the use of warning lights. Several of these individuals thought that the warning lights should be used during daylight hours as well.

A clear preference was shown that the interviewed representatives of ADOT construction offices throughout the state preferred to use vertical panels over both traffic cones and Type II barricades.

A review of accident reports occurring in construction zones associated with these three projects did not reveal any mention of motorists reporting problems seeing the Ultra Panels or understanding the construction traffic control. Forty-four accidents on I-17 and four on US 60

that involved a vehicle striking a vertical panel or barricade were reviewed.

Due to the limited number of construction related accidents occurring on SR 68, all forty-four accidents that occurred on this route were reviewed. None of the accident reports that were reviewed indicated that motorists expressed a problem seeing the Ultra Panels or other traffic control devices. None of the reported accidents on SR 68 involved a motorist colliding with a traffic channelizing device.

An informal survey of Department of Public Safety (DPS) Officers assigned to monitor the Phoenix freeway system indicated that these officers were supportive of the use of the Ultra Panels without warning lights. They felt that the addition of the warning lights to the Ultra Panel did not significantly improve drivers' ability to see the Ultra Panels. It is important to note that both sections of I-17 and US 60 in the Phoenix area have very high levels of ambient lighting.

ATSSA POSITION

The American Traffic Safety Service Association (ATSSA), an international trade association representing companies and individuals in the traffic control and roadway safety industry, stated for this record that they supported the use of steady-burn warning lights on traffic channelization devices used for nighttime road closures.

The Arizona Chapter of ATSSA echoed this position and has expressed their preference for the use of warning lights to ADOT on numerous occasions, including various ADOT and ATSSA partnering sessions.

ATSSA strongly supports the use of warning lights for the safety of their personnel and also the safety of workers in construction zones and the motoring public.

Table 1 - Results of Survey of State Transportation Departments

Question: Does your agency allow the use of ...	Yes	No	Some- times	No Response
Traffic Cones during the day?	34	0	0	0
Traffic Cones during the night?	21	13	0	0
Type I Barricades during the day?	14	20	0	0
Type I Barricades during the night?	11	23	0	0
Type II Barricades during the day?	19	15	0	0
Type II Barricades during the night?	17	17	0	0
Vertical Panel during the day?	22	12	0	0
Vertical Panel during the night?	19	15	0	0
Traffic Drums during the day?	34	0	0	0
Traffic Drums during the night?	34	0	0	0
In areas with established ambient lighting, does your agency require the use of ...	Yes	No	Some- times	No Response
Steady-burn warning lights with Type I Barricades?	0	26	4	4
Steady-burn warning lights with Type II Barricades?	1	26	5	2
Steady-burn warning lights with Vertical Panels?	0	27	3	4
Steady-burn warning lights with Construction Zone Signs?	2	26	5	1

The full report: *Light Use Study for Vertical Channelization Devices*, by David P. Sabers, Joseph J. Pluta and Michael Mancini (Arizona Department of Transportation, Report No. AZ-03-554, dated May 2003) is available on the Internet. Educational and governmental agencies may order print copies from the Arizona Transportation Research Center, 206 S. 17 Ave., MD 075R, Phoenix, AZ 85007; FAX 602-712-3400. Businesses may order copies through ADOT's Engineering Records Section.